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Allergic rhinitis in Latin America: knowledge, attitudes, and clinical practices of specialists in allergy and clinical immunology—CAPRA-SLAAI study

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Abstract
Allergic rhinitis (AR) is highly prevalent in Latin America (LA), impairing quality of life and often coexisting with asthma. In spite of dissemination of international guidelines, regional differences in diagnosis and management persist. The "Conductas, Actitudes y Prácticas de la Sociedad Latinoamericana de Alergia e Inmunología" (CAPRA-SLAAI) study aimed to assess the knowledge, attitudes, and practices on AR of allergists and clinical immunologists affiliated with SLAAI. Between November 2022 and March 2023, a standardized ARIA-adapted questionnaire (validated in Spanish/Portuguese) was distributed online to specialists from 24 countries; 784 were eligible for analysis. Nearly three-quarters were from Brazil (49.7%) and Mexico (25.8%), with a mean age of 50 years. Awareness of ARIA guidelines was almost universal; however, only 41% knew the MASK-air® digital tool, and fewer than 12% reported

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regular use, with low uptake in Brazil. Brazilian (BR) specialists more often reported extranasal symptoms and greater impact on daily activities, suggesting differences in presentation or reporting. Diagnostic strategies varied: BRs relied more on serum IgE and anterior rhinoscopy, whereas others used skin tests and imaging. Pharmacological treatment was similar across LA, with the use of second-generation antihistamines and intranasal corticosteroids. Immunotherapy approaches differed: subcutaneous and sublingual immunotherapy were more common outside BR, where pollinosis results in a greater variety of extracts. Conversely, allergen extracts are more standardized in Brazil. This survey reveals important regional contrasts and underscores the need for training, access to diagnostic tools, harmonized strategies, and greater integration of digital health solutions to optimize AR management in LA.

Introduction

Allergic rhinitis (AR) is a highly prevalent disease in Latin America (LA).[1] The International Study of Asthma and Allergies in Childhood (ISAAC), carried out in 44 centers in 14 countries in LA, revealed that the average prevalence of AR was 12.7% (5.5% to 21.2%) among 6- to 7-year-old schoolchildren and 18.5%, among adolescents aged 13 to 14 (7.1% to 45.1%).[1] More recently, the global asthma network (GAN), a successor study to ISAAC, documented a small reduction in these rates, in the two age groups evaluated, in the participating LA centers.[2]

Studies on the prevalence of AR in adults are scarce and many use the diagnosis of hay fever as a synonym for AR, which creates confusion.[3] Among parents of adolescents evaluated in Uruguaiana, located in the southern region of Brazil, the average prevalence of AR was 31.7% against 28.0% observed among their children.[4]

Although it is a disease that does not expose the individual to the risk of death, its impact on patients' quality of life is significant and often debilitating.[5] More than a decade ago, the Allergies in Latin America (AILA) study evaluated more than 22,000 individuals, above of 4 years of age, diagnosed with nasal allergy for at least 1 year, residing in Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, and Venezuela in terms of symptoms, impact of nasal allergies on the quality of life of these patients, and about the treatments received.[6] Nasal obstruction was the most mentioned symptom and the one that bothered patients the most. Furthermore, there was compromised productivity at work and school, impaired sleep, and compromised quality of life.[6] Regarding the treatments received, there were also disappointments and expectations of greater effectiveness.[6] These results had already been reported in a similar study in other parts of the world.[7]

In spite of growing evidence of the impact of AR on patients' lives and the various guidelines that attempt to standardize its treatment,[5,8] AR is still an underestimated and undervalued disease. Could it be because of a lack of therapeutic resources, or because of a lack of knowledge of the doctor who treats these patients? The objectives of CAPRA-SLAAI study (Spanish acronym for *"Conductas, Actitudes y Prácticas de la Sociedad Latinoamericana de Alergia e Inmunología"*) were to evaluate the level of knowledge, attitudes, and prescriptions by allergists and immunologists from different regions of LA when managing patients with AR.

Materials and Methods

Study population

Allergists and clinical immunologists from LA and affiliated with the Sociedad Latinamericana de Alergia, Asma e Inmunologia participated in the study. The questionnaire used was developed based on the self-administered questionnaire, in the English version, of the ARIA One Airways Questionnaire, translated into Portuguese (BR culture) and Spanish, and validated for use,[1] and made available via email (Google forms) to SLAAI members, via local societies. The translations of the written questionnaire (WQ) followed all the steps defined by the Delphi Method with the participation of 10 specialists in allergy and clinical immunology from different LA countries.

This method is used to capture a wide variety of opinions transmitted anonymously with a high degree of reliability, involving experts in equal participation, regardless of hierarchy, and their contributions allow finding criteria and consensus with a high level of objectivity. The questions selected to constitute the final WQ were those that received more than 70% approval from experts.[9]

After all suggestions were made, and the final version of the WQ was incorporated into the Google Forms online platform: https://forms.gle/pP7JmvRJc6bjSoja7 for the Spanish version and https://forms.gle/E253NUHN8LPjKZPk8__in Portuguese. Participants were categorized by their email address to avoid duplication of responses. The WQ consists of three parts: general data, knowledge, and attitudes and practices; demographic data; age; country; place of work; length of service as a specialist; type of institution where you work; the number of patients treated with AR; and the number of patients treated with AR and asthma. Next, knowledge of AR and the ARIA guide was assessed as well as attitudes and practices in AR (Supplementary file 1).

The inclusion criteria were: being a physician specializing in allergy and clinical immunology, being a member of one of the different specialist societies associated with SLAAI, agreeing to participate in the study by signing the

digital informed consent form (ICF), providing an email address, and responding appropriately to the first and at least one other part of the questionnaire.

For statistical analysis, responses submitted through the WQ were automatically transferred to the database linked to Google Forms. Participants who did not meet all inclusion criteria were eliminated from the study. For analysis purposes, the experts were divided between those from Brazil and other participating countries, taking the former as a reference ("risk" odds). Descriptive statistics were reported by frequency, mean, and standard deviation (SD). To compare the means between the two groups, the *t*-Student test and analysis of variance (ANOVA) were used, and to compare the distribution of dichotomous variables, the Chi-square test, crude odds ratio (COR_c), and their respective 95% confidence intervals (95%CI) were used. Next, multivariate models were constructed using the variables that showed significant associations in the univariate analysis in order to assess their independence using ordinal logistic regression, adjusted OR, and their 95% CI. Associations with a *p*-value of <0.05 were considered significant. All analyses were performed using STATA 23.0 software (StataCorp, CollegeStation, TX, USA).

Results

A total of 799 specialists in allergy and clinical immunology completed the WQ between November 2022 and March 2023. Fifteen were excluded because they were incomplete or did not meet the eligibility criteria, resulting in 784 valid questionnaires for analysis. These valid questionnaires analyzed were provided by participants from 24 different countries, all affiliated with SLAAI. Among them, 390 (49.7%) were from Brazil and 202 (25.8%) from Mexico (Supplementary file 2). The total mean age was 50.1 years (SD:12.3; Min:28;Max:86). There was no significant age difference between BR participants (49.9 years old) and NBR participants (50.2 years old) (p=0.13).

The main characteristics of the study population and the weekly number of patient consultations are summarized in Table 1.

In general, we observed a predominance of doctors working in private services over those from other institutions, and a greater participation of specialists from university services among BR. The majority of participants treat between 11 and 30 patients with asthma and rhinitis weekly; however, a statistically significant difference is observed in the number of patients treated with the association of asthma and rhinitis among NBRs.

Supplementary file 3 compares knowledge about the main guidelines and assessment tools for AR, attitudes and practices regarding diagnosis, and therapy, including immunotherapy among all participants according to the study group.

Tables 2–6 demonstrate the results of multivariate analysis between the associations that were statistically significant in relation to knowledge about the ARIA

Table 1 Demographic and professional characteristics of participants and weekly number of patient consultations (N=784).

Variables	BR		NBR		95% CI	*p**
	N	%	N	%		
Time as a specialist						
1 year	75	19.8	83	21.1	−0.11-0.22	*0.52*
5-10 years	43	11.3	46	11.7		
10-20 years	85	22.4	92	23.4		
>20 years	176	46.4	173	43.9		
Type of institution						
Public hospital	17	4.5	49	12.4	0.07-0.33	*0.02*¶
Private service	161	42.5	210	53.3		
University hospital	135	35.6	42	10.7		
Public + private	66	17.4	93	23.6		
Number of patients with rhinitis seeked per week						
<10	44	11.3	39	10.0	0.013-0.29	*0.032*¶
from 11 to 30	220	56.4	225	57.5		
>30	115	29.5	127	32.5		
Number of patients with asthma seeked per week						
<10	162	41.5	136	34.5	−0.078-0.22	*0.34*
From 11 to 30	185	47.4	204	51.8		
>30	32	8.2	54	13.7		
Number of patients with rhinitis+asthma seeked per week						
<10	144	36.9	111	28.2	0.254-0.072	0.000¶
From 11 to 30	207	53.1	214	54.3		
>30	39	10.0	69	17.5		

BR: Brazilians; NBR: Non-Brazilians; 95% CI: 95% confidence intervals; *ANOVA (Analysis of variance); **p*=Chi-square test; italic ¶ = significant.

Table 2 Multivariate analysis of the main knowledge about ARIA guidelines/mask-air according to the study groups.

Variables	BR		NBR		OR_c	95% CI	*p**	OR_{aj}	95% CI	*p**
	N	%	N	%						
Do you know the MASK-AIR digital application?										
YES	124	32.0	200	50.9	0.45	0.33-0.60	*0.000*¶	0.47	0.34-0.65	*0.000*¶
Do you use the MASK-AIR digital app?										
YES	33	8.5	56	14.3	0.55	0.35-0.87	*0.007*¶	0.92	0.56-1.53	*0.76*
Do you ask the patient if a doctor has told him that he has allergic rhinitis?										
Always/often	313	80.3	344	87.3	**0.59**	0.40-0.87	*0.009*¶	0.65	0.44-0.98	*0.04*¶

BR=Brazilians; NBR=Non-Brazilians; OR_C=crude odds ratio; 95% CI = 95% confidence interval; OR_{aj} = odds ratio adjusted by MASK-AIR knowledge; Use of MASK-AIR; Medical diagnosis of rhinitis; **p* = Chi-square test; italic ¶ = significant.

Table 3 Multivariate analysis of the main symptoms related to allergic rhinitis according to the study groups

Variables	BR		NBR		OR_c	95% CI	*p**	OR_{aj}	95% CI	*p**
	N	%	N	%						
Eye itching										
YES	367	94.1	137	34.8	31.3	19.2-50.4	*0.012*¶	52.1	29.5-92.2	*0.000*¶
Headache										
YES	50	12.8	27	6.9	1.9	1.22-3.26	*0.000*¶	0.31	0.15-0.61	*0.001*¶
Wheezing										
YES	11	2.8	2	0.5	5.6	1.25-25.8	*0.012*¶	0.69	0.08-5.70	*0.73*
Shortness of breath										
YES	16	4.1	2	0.5	8.38	1.91-36.7	*0.001*¶	6.08	0.91-40.2	*0.061*
Cough										
YES	94	24.1	28	7.1	4.15	2.65-6.50	*0.000*¶	11.0	5.63-21.8	*0.00*¶
Difficulty sleeping										
YES	151	38.7	96	24.4	**1.95**	**1.43-2.65**	***0.000***¶	**0.635**	**0.40-0.98**	***0.044***¶
Difficulty performing exercises										
YES	47	12.1	27	6.9	**1.86**	**1.13-3.05**	***0.014***¶	0.89	0.43-1.85	*0.76*

BR=Brazilians; NBR=Non-Brazilians; OR_c=crude odds ratio; 95% CI = 95% confidence interval; OR_{aj} = odds ratio adjusted for eye itching, headache, wheezing, shortness of breath, cough, impaired sleep, and exercise; **p* = Chi-square test; italic¶ = significant.

Table 4 Multivariate analysis of diagnostic practices according to study groups.

Variables	BR		NBR		OR_c	95% CI	*p**	OR_{aj}	95% CI	*p**
	N	%	N	%						
Anterior rhinoscopy										
Always/often	357	91.8	315	80.6	2.69	1.73-4.17	*0.000*¶	1.67	1.37-2.05	*0.000*¶
Images of the paranasal sinuses (Rx, CT, MRI)										
Always/often	51	13.1	131	33.2	0.30	0.21-0.43	*0.000*¶	0.49	0.40-0.60	*0.000*¶
Skin tests										
Always/often	356	91.3	384	97.5	0.27	0.13-0.56	*0.000*¶	0.41	0.30-0.56	*0.000*¶
Total IgE										
Always/often	243	62.3	211	53.6	1.43	1.07-1.90	*0.014*¶	1.05	0.84-1.19	0.95
Specific serum IgE										
Always/often	315	80.8	174	44.2	5.31	3.85-7.31	*0.000*¶	3.17	2.53-3.97	*0.000*¶

BR=Brazilians; NBR=Non-Brazilians; OR_C=crude odds ratio; 95% CI=95% confidence interval; OR_{aj}=odds ratio adjusted by anterior rhinoscopy, paranasal radiography, prick test, total IgE, sIgE; **p*=Chi-square test; italic¶= significant.

Table 5 Multivariate analysis of therapeutic practices according to the study groups.

Variables	BR		NBR		OR_c	95CI%	p*	OR_{aj}	95CI%	p*
	N	%	N	%						
1st generation antihistamines										
Always/often	15	3.8	37	9.4	0.38	0.20-0.71	*0.002*¶	0.75	0.58-0.99	*0.045*¶
Combination of antihistamine+systemic vasoconstrictor										
Always/often	30	7.7	91	23.2	0.27	0.17-0.43	*0.000*¶	1.16	0.90-1.51	*0.23*
Intranasal antihistamines										
Always/often	50	12.9	155	39.5	0.22	0.15-0.32	*0.000*¶	0.57	0.45-0.71	*0.000*¶
Intranasal decongestants										
Always/often	6	1.6	44	11.3	0.12	0.05-0.29	*0.000*¶	0.26	0.19-0.37	*0.000*¶
Combination of intranasal topical antihistamines + intranasal topical corticosteroids										
Always/often	251	64.5	334	84.8	0.32	0.23-0.46	*0.000*¶	0.67	0.54-0.82	*0.000*¶
Oral corticosteroids										
Always/often	370	94.9	357	90.8	0.23	0.30-0.94	*0.037*¶	1.54	0.75-3.15	0.23
Intranasal disodium chromoglycate										
Always/often	15	3.8	36	9.1	0.53	0.39-0.21	*0.03*¶	0.93	0.42-2.06	0.85
Type of immunotherapy										
SCIT										
Always/often	278	71.3	307	77.9	0.70	0.50-0.97	*0.03*¶	0.57	0.40-0.80	*0.001*¶
SLIT										
Always/often	203	52.1	245	62.2	0.66	0.49-0.87	*0.001*¶	0.55	0.41-0.75	*0.000*¶
Do you use standardized allergens?										
YES	369	94.6	354	89.8	1.98	1.14-3.43	*0.016*¶	2.56	1.44-3.43	*0.001*¶
Most used allergens										
Mites										
YES	385	98.7	369	93.7	5.21	1.97-13.77	*0.000*¶	1.23	0.43-3.50	0.69
Fungi										
YES	49	12.6	71	18.0	0.65	0.44-0,97	*0.037*¶	0.42	0.25-0,69	*0.001*¶
Pollens										
YES	58	14.9	305	77.4	0.051	0.035-0.07	*0.000*¶	0.048	0.,03-0.,07	*0.000*¶

BR=Brazilians; NBR=Non-Brazilians; OR_c=crude odds ratio; 95%CI=95% confidence interval; ORaj= odds ratio adjusted by antih1, antih+desc, antih1-intranasal, intranasal decongestants, antih-1+ intranasal corticosteroid, systemic corticosteroid, and disodium chromoglycate; SCIT=subcutaneous immunotherapy; SLIT=sublingual immunotherapy; §ORadjust=odds ratio adjusted by SCIT, SLIT, standardization; mites, fungi, and pollens; **p*=Chi-square test; italic¶= significant.

guidelines, main symptoms, diagnosis, and therapy, respectively, according to the study group. Regarding the ARIA guidelines, almost all participants responded affirmatively that they knew the main concepts contained in this guide (Supplementary file 3). On the other hand, only 41% of the sample knew the Mobile Airways Sentinel NetworK (MASK-AIR) application and less than 12% used it in their daily lives (Table 2). This tool is more widespread in other countries than in Brazil, but its use was very low in the general sample. The frequency of questions about the probable diagnosis of AR made by another doctor during the anamnesis was lower among BR (Table 2).

There were no significant differences in the frequency of classic symptoms of AR, such as runny nose, sneezing, itching, and nasal obstruction, between BR specialists and those from other countries (Supplementary file 3). On the other hand, the former indicated a significantly higher frequency of extranasal symptoms (eye itching, headache, wheezing, shortness of breath, and cough) and impact on daily activities (sleep/exercise) than the latter (Table 3). "Wheezing" and "shortness of breath" were not statistically significant in the multivariate analysis, probably because they represent the same symptom, that is, because they are competing variables. Interference with exercise also were not significant in this analysis.

In Table 4, we observe the most used practices for diagnosing AR in the two groups of specialists studied. The significantly greater use of serological tests among BR is noteworthy, to the detriment of skin tests with aeroallergens, which are more used by other participants. Conversely, there was greater use of imaging exams by NBR specialists in contrast to the greater frequency of nasal cavity examination by BR specialists.

The frequency of prescription of different medicines, specific immunotherapy, and allergens used in the treatment of AR are listed in Table 5. We observed that second-generation antihistamines and intranasal corticosteroids, considered first-line medications in the treatment of AR, were used consistently by the entire sample (Supplementary file 3). Leukotriene antagonists were used by around 70% of participants and homeopathy by a very small number of specialists (Supplementary file 3). Compared to BR, the other group used significantly more first-generation oral antihistamines, combination of oral

Table 6 Main second-generation antihistamines and topical intranasal corticosteroids used in the treatment of allergic rhinitis, according to the study groups

Main compounds	BR		NBR		OR	95% CI	p
	N	%	N	%			
Antihistamines							
Cetirizine							
Yes	30	7.7	148	37.6	0.13	0.09-0.21	*0.000*¶
Loratadine							
Yes	95	24.4	98	24.9	0.97	0.70-1.34	0.869
Levocetirizine							
Yes	199	51.0	260	66.0	0.53	0.40-0.71	*0.000*¶
Desloratadine							
Yes	272	69.7	151	38.3	3.71	2.75-4.99	*0.000*¶
Fexofenadine							
Yes	268	68.7	199	50.5	2.15	1.60-2.88	*0.000*¶
Bilastine							
Yes	252	64.6	149	37.8	3.00	2.24-4.01	*0.000*¶
Rupatadine							
Yes	6	1.5	105	26.6	0.04	0.019-0.09	*0.000*¶
Intranasal corticosteroids							
Mometasone furoate							
Yes	371	95.1	347	88.1	2.64	1.52-4.59	*0.000*¶
Fluticasone furoate							
Yes	306	78.5	299	75.9	1.15	0.82-1.61	0.39
fluticasone propionate							
Yes	122	31.3	143	36.3	0.79	0.59-1,07	0,15
Budesonide							
Yes	242	62.1	158	40.1	2.44	1.83-3.25	*0.000*¶
Beclomethasone dipropionate							
Yes	14	36	34	8.6	0.39	0.20-0.74	*0.004*¶
Ciclesonide							
Yes	365	93.6	331	84.2	0.36	0.22-0.59	*0.000*¶

BR=Brazilians; NBR=Non-Brazilians; OR=odds ratio; 95% CI = 95% confidence interval; *p = Chi-square test; italic¶ = significant.

antihistamines with decongestants, intranasal antihistamines, intranasal decongestants, combination of antihistamines with intranasal corticosteroids, systemic corticosteroids, and disodium cromoglycate (Table 5).

In general, both subcutaneous immunotherapy (SCIT) and sublingual immunotherapy (SLIT) were more used by NBR, in spite of standardized extracts being more frequently used in Brazil. Except for animal epithelia (Supplementary file 3), there were significant differences in relation to the type of extract used, especially in relation to pollens and fungi. After adjusting the variables, "dust mites" lost statistical significance (Table 5). The two groups studied differed in terms of the number of extracts used in immunotherapy: BR used significantly fewer extracts (>3 extracts used: 9.3% × 31.7%, BR and NBR, respectively; *p<0.001*). There was no difference in terms of the time of immunotherapy use between the two groups (*p=0.063*).

Table 6 lists the main second-generation antihistamine compounds and intranasal corticosteroids used by participants to treat AR. There were significant differences in prescribing for virtually all antihistamines except loratadine. BR prescribe more desloratadine, fexofenadine, and bilastine, while in other countries cetirizine, levocetirizine, and rupatadine prevail. Among intranasal corticosteroids, the scenario is practically the same. Except for fluticasone compounds, BR prescribe more mometasone, budesonide, and ciclesonide, while in other countries the prescription of beclomethasone prevails.

Discussion

This multicenter study, organized by the SLAAI and conducted in 24 countries, predominantly in LA, with additional participation from Spain, Portugal, and Italy (<5% of the sample), provided a comprehensive analysis of the knowledge, attitudes, and practices of specialists in allergy and clinical immunology in the management of AR. The findings highlight the wide dissemination of international guidelines while also revealing important differences in diagnostic and therapeutic approaches between BR specialists and those from Spanish-speaking countries.

The almost universal awareness of the ARIA guidelines confirms their consolidation as an international standard.[1,10]

However, the limited familiarity with and restricted use of digital monitoring tools, particularly in Brazil, reveal an important gap in the incorporation of these technologies into clinical follow-up.[11] The dissemination of digital resources for symptom monitoring could enhance treatment adherence and optimize disease control, an aspect that remains underexplored in our region.[12]

With regard to clinical presentation, no differences were observed in the frequency of classical AR symptoms between groups, suggesting relative uniformity of the disease phenotype. However, BR specialists reported a higher frequency of extra-nasal symptoms and greater impact on daily activities, such as sleep and exercise. This finding may indicate greater disease severity among patients treated in Brazil, higher coexistence with asthma, or differences in how symptoms are recorded and valued by professionals. Diagnostic strategies revealed relevant contrasts. In Brazil, serum tests (total and specific IgE) were more frequently used, whereas in Spanish-speaking countries skin tests and imaging examinations were more common. The greater use of anterior rhinoscopy in Brazil suggests a stronger emphasis on direct physical examination, while the lower use of skin tests may be related to logistical and access barriers.

These findings should be interpreted with caution, as the cross-sectional design does not allow causal inferences, and also in light of the structural heterogeneity of LA health systems, which combine universal public models, mixed systems, and arrangements with strong participation of the private sector. This diversity influences not only the availability of diagnostic and therapeutic resources but also the prioritization of values such as equity, efficiency, and sustainability, shaped by the political, economic, and ideological contexts of each country.[13]

In addition, training in allergy and clinical immunology shows great heterogeneity across the region, with some countries where the specialty is well established and others where it is still scarcely incorporated into undergraduate curricula and residency programs. Studies indicate that this disparity compromises the standardization of care and access to specialized allergy services in LA.[14,15]

From a therapeutic perspective, there was uniformity in the use of second-generation antihistamines and intranasal corticosteroids, considered first-line drugs for the treatment of AR.[10] On the other hand, the high prescription rate of leukotriene antagonists—used by approximately 70% of participants—was noteworthy, possibly because of the frequent coexistence with asthma.[5,10] Regional differences in the prescription of antihistamines and intranasal corticosteroids appear to be strongly linked to pharmaceutical market availability and local health policies.[13] In Brazil, the higher use of drugs such as desloratadine, fexofenadine, bilastine mometasone, budesonide, and ciclesonide can be attributed both to their wide availability in the market and to facilitate access through governmental programs. Within the unified health system, specifically through the Ministry of Health's Programa Farmácia Popular ("Popular Pharmacy Program"), budesonide, beclomethasone, and loratadine are offered, which contributes to their use as baseline therapies in the country.[16] In other countries, the preference for cetirizine, levocetirizine, rupatadine, and beclomethasone possibly reflects different regulatory contexts.[13]

With regard to allergen-specific immunotherapy (AIT), SCIT and SLIT were more frequently used in Spanish-speaking countries, whereas in Brazil the use of standardized extracts predominated. This difference may be attributed both to epidemiological factors, such as the higher prevalence of pollens in certain regions and to regulatory and cost-related aspects.[17] In addition, BR specialists reported using a smaller number of extracts, which may be related both to the adoption of standardized protocols and to financial constraints. These findings should be interpreted in the context of the LA literature on AIT, which highlights the scarcity of prospective comparative studies and the marked heterogeneity across countries and even within the same country.[17] In Brazil, although specific guidelines for AIT in AR exist, the country's continental dimensions and environmental diversity result in distinct sensitization patterns and variability in extract availability, which impose additional challenges to the standardization of clinical practice.[18]

Another point that deserves emphasis is that, although participants demonstrated a high level of knowledge regarding the ARIA recommendations, there remains a need to advance in the conceptual and terminological harmonization concerning AR. Recent initiatives have emphasized not only the adoption of personalized medicine strategies and digital integration but also the development of a unified vocabulary regarding the definition of control, remission, exacerbation, and disease progression. Such standardization, in addition to facilitating communication between specialists and general practitioners, has the potential to improve the practical implementation of recommendations and to strengthen the physician–patient relationship.[19, 20]

Its use enables the real-time collection of patient-reported data and allows for a more accurate phenotypic stratification of the disease, including its association with asthma and the impact on ocular and nasal symptoms.[21] In addition, the most recent ARIA 2024 proposals reinforce the potential of artificial intelligence (artificial intelligence) in building personalized, patient-centered care pathways.[22] These AI-enabled digital models not only facilitate adherence to international recommendations but also support clinical decision-making, promote the standardization of practices, and foster the implementation of more equitable care across different health care contexts.[21-23]

Overall, the findings of this study highlight the need to reduce regional disparities and promote greater standardization in the diagnosis and treatment of AR in LA. Priority strategies include expanding knowledge and use of digital tools, improving access to validated diagnostic methods, promoting the rational use of medications, and reassessing health policies that directly affect the availability of AIT and first-line drugs.

Among the limitations of this study, the cross-sectional design should be noted, as it does not allow causal inferences. Furthermore, although participants were drawn from more than 20 countries, the sample was predominantly composed of specialists from countries with stronger training structures,[14] with nearly three-quarters concentrated in Brazil (49%) and Mexico (29.5%). This distribution may not fully reflect the regional diversity and should be considered when interpreting and generalizing the findings

Conclusions

This multicenter study highlights important regional differences in the management of AR in LA and underscores the need for future, more representative investigations that take into account professional training, the particularities of health systems, and the growing role of digital technologies and AI in the care of AR and its comorbidities. These recommendations are relevant not only for specialists but also for general practitioners, given the very high prevalence of rhinitis in our continent.

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Mandatory Disclosure on Use of Artificial Intelligence

The authors declare that no AI-assisted tools were used in the preparation of this manuscript. All references have been manually verified for accuracy and relevance.

Author Contributions

All authors contributed equally to this article.

Conflict of Interest

The authors declare no potential conflicts of interest with respect to research, authorship, and/or publication of this article.

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Supplementary

Supplementary file 1 Written questionnaire on knowledge, attitudes, and practices of specialists in allergic rhinitis

PART I. General Data

1. Age: _____ years
2. Country:
3. How long have you worked as an allergy specialist?
   a) 1 year ( ), b) 1 to 5 years ( ), c) 6 to 10 years ( ), d) more than 10 years ( ), e) more than 20 years ( )
4. What type of institution do you work in? (you can select more than one alternative)
   a) Public hospital ( ), b) Consultancy/Private Hospital ( ), c) University Hospital ( )
5. Number of patients seen with rhinitis per week.
   a) Less than 10 ( ), b) from 11 to 30 ( ), c) more than 30 ( )
6. Number of patients seen with asthma per week.
   a) Less than 10 ( ), b) from 11 to 30 ( ), c) more than 30 ( )
7. Number of patients seen with rhinitis and asthma per week.
   a) Less than 10 ( ), b) from 11 to 30 ( ), c) more than 30 ( )

PART II. Knowledge

8. Do you know the ARIA guidelines (Allergic Rhinitis and its Impact on Asthma)? YES ( ) NO ( )
9. Do you know how to classify the severity of allergic rhinitis (AR)? YES ( ) NO ( )
10. What are the main symptoms of AR? (you can select more than one alternative)
    a) Runny nose
    b) Sneezing
    c) Nasal itching
    d) Nasal obstruction
    e) Eye itching
    f) Headache
    g) Wheezing in the chest
    h) Shortness of breath
    i) Cough
    j) Difficulty sleeping
    k) Difficulty performing exercises

Always	Often	Rarely	Never

Answer the alternatives below according to how often you ask the patient.

11. Do you ask the patient if they have these symptoms all the time or at specific times of the year?
12. Do you ask the patient if these symptoms occur when they are near pets or exposed to an allergen at home or at work?
13. Do you ask the patient if a doctor has told him that he/she has AR?
14. Do you ask if he/she also has shortness of breath or wheezing?
15. Do you ask the patient if a doctor has told him/her that he/she has asthma?
16. In this case, do you ask the patient if rhinitis symptoms worsen their asthma?
17. Do you ask the patient if rhinitis symptoms interfere with daily activities (school, work)?
18. Do you ask the patient if they have other associated diseases and use other medications?

PART III. Attitudes and Practices

Answer the alternatives below according to how often you use them in your clinical practice.

Always	Often	Rarely	Never

19. You diagnose your patient's allergic rhinitis through
    a) Clinical history
    b) Anterior rhinoscopy
    c) Allergy tests
    d) Images of the paranasal sinuses (Rx, CT, MRI)
    e) Nasal endoscopy

Always	Often	Rarely	Never

20. What diagnostic tests do you use to diagnose your patient's AR?
    a) Skin tests
    b) Total IgE in serum
    c) Specific serum IgE
    d) Serum eosinophilia
    e) Lung function tests

21. What medications do you use to treat your patient's AR?
    a) First-generation antihistamines
    b) Second-generation antihistamines
    c) Combination of antihistamine + systemic vasoconstrictor
    d) Intranasal antihistamines
    e) Nasal topical vasoconstrictors
    f) Intranasal topical corticosteroids
    g) Combination of antihistamines + intranasal topical corticosteroids
    h) Oral corticosteroids
    i) Intranasal disodium chromoglycate
    j) Leukotriene antagonists
    j) Combination of antihistamines + leukotriene antagonists
    k) Homeopathy
22. Name the second-generation antihistamines that you use most (maximum three):
23. Name the intranasal topical corticosteroids you use most (maximum three):

Always	Often	Rarely	Never

24. If you use AIT to treat AR, what route of administration do you use?
    a) Subcutaneous
    b) Sublingual
25. Do you use standardized allergens?
26. How many allergens do you use?
    a) 1 ( ), b) 2 years ( ), c) 3 years ( ), d) > 3 years ( )
27. How long does the AIT indicate?
    a) 1 year ( ), b) 1 to 2 years ( ), c) 2 to 3 years ( ), d) > 3 years ( )
28. Name the allergens you use most (maximum three):
29. Do you know the MASK-AIR digital application?
    YES ( ) NO ( )
30. Do you use the MASK-AIR digital app?
    YES ( ) NO ( )

Supplementary file 2 Countries of activity of specialists.

Country	N	%
Brazil	390	49.7
Mexico	202	25.8
Argentina	42	5.4
Chile	26	3.3
Spain	26	3.3

Total specialists = 784; Other participating countries: Bolivia (4), Colombia (24), Costa Rica (3), Cuba (11), Ecuador (10), El Salvador (1), France (1), Guatemala (1), Honduras (5), Italy (3), Nicaragua (1), Panama (2), Paraguay (1), Peru (14), Portugal (5), Dominican Republic (4), Uruguay (2), and Venezuela (5).

Supplementary file 3 Comparative analysis of responses on knowledge, attitudes, and practices in relation to allergic rhinitis according to the study group.

Varables	BR		NBR		OR	95% CI	*p**
	N	%	N	%			
Knowledge aria/mask—air guidelines							
Do you know the ARIA Guidelines?							
YES	388	99.5	391	99.2	1.48	0.24-8.95	*1.00*
Do you know how to classify the severity of allergic rhinitis?							
YES	381	97.7	385	97.7	0.99	0.38-2.52	*1.00*
Do you know the MASK-AIR digital application?							
YES	124	32.0	200	50.9	0.45	0.33-0.60	*0.000*¶
Do you use the MASK-AIR digital app?							
YES	33	8.5	56	14.3	0.55	0.35-0.87	*0.007*¶
Do you ask the patient if they have these symptoms all the time or at specific times of the year?							
Always/often		99.7	394	100	1.00	0.99-1.00	*0.49*
Do you ask the patient if these symptoms occur when they are near pets or exposed to an allergen at home or at work?							
Always/often	386	99.0	391	99.2	0.8	0,74-0.16	*0.33*
Do you ask the patient if a doctor has told him that he has allergic rhinitis?							
Always/often	313	80.3	344	87.3	0.59	0.40-0.87	*0.009*¶
Do you ask the patient if a doctor has told him that he has asthma?							
Always/often	376	96.4	374	94.9	1.43	0.71-2.88	*0.38*
In this case, do you ask the patient if rhinitis symptoms worsen their asthma?							
Always/often	362	92.8	370	94.4	0,76	0.43-1.36	*0.38*
Do you ask the patient if rhinitis symptoms interfere with daily activities (school, work)?							
Always/often	385	98.7	392	99.5	0.39	0.076-2.03	*0.28*
Do you ask the patient if they have other associated diseases and use other medications?							
Always/often	388	99.5	390	99.0	1.99	0.36-10.9	*0.68*
Knowledge about the main symptoms related to allergic rhinitis							
Runny nose							
YES	370	94.9	374	94.9	0.98	0.52-1.86	*1.000*
Sneezing							
YES	386	99.0	392	99.5	0.49	0.09-2.70	*0.44*
Nasal itching							
YES	387	99.2	389	98.7	1.65	0.39-6.98	*0.72*
Nasal obstruction							
YES	379	97.2	379	96.2	1.36	0.61-3.00	*0.55*
Eye itching							
YES	367	94.1	137	34.8	31.3	19.2-50.4	*0.012*¶
Headache							
YES	50	12.8	27	6.9	1.9	1.22-3.26	*0.000*¶
Wheezing							
YES	11	2.8	2	0.5	5.6	1,25-25.8	*0.012*¶
Shortness of breath							
YES	16	4.1	2	0.5	8.385	1.91-36.7	*0.001*¶
Cough							
YES	94	24.1	28	7.1	4.151	2.65-6.50	*0.000*¶
Difficulty sleeping							
YES	151	38.7	96	24.4	1.95	1.43-2.65	*0.000*¶
Difficulty performing exercises							
YES	47	12.1	27	6.9	1.86	1.13-3.05	*0.014*¶

(*continues*)

Supplementary file 3 Continued.

Varables	BR		NBR		OR	95%CI	p*
	N	%	N	%			
Attitudes and practices—diagnosis							
Clinical history							
Always/often	388	99.5	390	99.0	1.99	0.36-10.9	*0,68*
Anterior rhinoscopy							
Always/often	357	91.8	315	80.6	2.69	1.73-4.17	*0.000*¶
Images of the paranasal sinuses (rx, CT, MRI)							
Always/often	51	13.1	131	33.2	0.30	0.21-0.43	*0.000*¶
Nasal endoscopy							
Always/often	48	12.3	47	11.9	1.03	0.67-1.59	*0.91*
Skin tests							
Always/often	356	91.3	384	97,5	0.27	0.13-0.56	*0.000*¶
Total IgE in serum							
Always/often	243	62.3	211	53,6	1.43	1.07-1.90	*0.014*¶
Specific serum IgE							
Always/often	315	80.8	174	44.2	5.31	3.85-7.31	*0.000*¶
Serum eosinophilia							
Always/often	199	51.0	190	48.3	1.11	0.84–1.47	*0.47*
Lung function tests							
Always/often	105	26.9	117	29.7	0,87	0.63–1.19	*0.42*
Attitudes and Practices—Therapeutic							
First-generation antihistamines							
Always/often	15	3.8	37	9.4	0.38	0.20-0.71	*0.002*¶
Second-generation antihistamines							
Always/often	346	88.7	358	90.9	0.79	0.49-1.25	*0.34*
Combination of antihistamine+systemic vasoconstrictor							
Always/often	30	7.7	91	23.2	0.27	0.17-0.43	*0.000*¶
Intranasal antihistamines							
Always/often	50	12.9	155	39.5	0.22	0.15-0.32	*0.000*¶
Intranasal decongestants							
Always/often	6	1.6	44	11.3	0.12	0.05-0.29	*0.000*¶
Intranasal topical corticosteroids							
Always/often	375	96.4	375	95.4	1,28	0.63-2.62	*0.58*
Combination of intranasal topical antihistamines + intranasal topical corticosteroids							
Always/often	251	64.5	334	84.8	0.32	0.23-0.46	*0.000*¶
Oral corticosteroids							
Always/often	36	9.2	20	5.1	0.53	0.30-0.94	*0.037*¶
Intranasal disodium chromoglycate							
Always/often	15	3.8	36	9.1	0.53	0.39-0.21	*0.03*¶
Leukotriene antagonists							
Always/often	271	69.7	280	71.1	1.06	0.78-1.45	*0.696*
Combination of antihistamines + leukotriene antagonists							
Always/often	106	27.2	119	30.2	0.86	0.63-1.18	*0.385*
Homeopathy							
Always/often	8	2.1	14	3.6	0.56	0.23-1.37	*0.280*
Attitudes and Practices—Immunotherapy							
Type of immunotherapy							
SCIT							
Always/often	278	71.3	307	77.9	0.70	0.50-0.97	*0.03*¶
SLIT							
Always/often	203	52.1	245	62.2	0.66	0.49-0.87	*0.001*¶

(*continues*)

Supplementary file 3 Continued.

Varables	BR		NBR		OR	95%CI	*p**
	N	%	N	%			
Do you use standardized allergens?							
YES	369	94.6	354	89.8	1.98	1.14–3.43	*0.016*¶
Most used allergens							
Mites							
YES	385	98.7	369	93.7	5.21	1.97–13.77	*0.000*¶
Fungi							
YES	49	12.6	71	18.0	0.65	0.44–0.97	*0.037*¶
Animal danders							
YES	153	39.2	164	41.6	0.905	0.68–1.20	*0.51*
Pollens							
YES	58	14.9	305	77.4	0.051	0.035–0.07	*0.000*¶

BR=Brazilians; NBR=Non-Brazilians; OR=odds ratio; 95% CI=95% confidence interval; **p* = Chi-square test; italic¶ = significant.